

The first record of *Boloria frigga* (Lepidoptera: Nymphalidae) on Kolguev Island, Arctic Russia

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Abstract

A new record of *Boloria frigga* from the Arctic islands of European Russia is given. Image of a captured specimen, as well as brief considerations on the species habitat, are provided.

Keywords

Biogeography, Arctic islands, Barents Sea region, butterflies, fauna.

Frigga's fritillary, *Boloria frigga* (Thunberg, 1791), is a butterfly species with a circumboreal distribution. Its range includes Fennoscandia, the Baltic countries, Northern European Russia, Siberia, Mongolia, the Russian Far East, Alaska, the Rocky Mountains of the western states of the U.S., the Great Lakes, Quebec, and State of Maine (Tuzov and Bozano 2006; de Maynadier 2009; Haahtela et al. 2017; Söderström 2019).

In Fennoscandia and Northern European Russia, the range of *B. frigga* includes most of the part of this region, but it is a generally local species (Tatarinov 2016; Söderström 2019). Here, *B. frigga* prefers moss and shrub tundra, herb meadow patches in the tundra and raised bogs. Their caterpillars are known as the specialists and feed on the cloudberry (*Rubus chamaemorus*) (Tatarinov and Dolgin 1999). This is the main reason why *B. frigga* is rarer towards the south in the European part of

Russia, where the raised bogs are less common. The southern border of the species distribution is up to the Tver Oblast (Tuzov and Bozano 2006; Dubatolov et al. 2019). Here, in some regions of this part of European Russia, *B. frigga* is included in the Red List of Species, i.e. the Leningrad Oblast (2018), the Novgorod Oblast (2015), and the Tver Oblast (2016). The main threats to *B. frigga* are peat extraction and the draining of bogs.

The reliable records of *B. frigga* are relatively few in Northern European Russia. For example, there are no records of this species from the Arkhangelsk Oblast (Kozlov et al. 2014, 2017, 2020). The distribution of *B. frigga* is better acquainted for the Murmansk Oblast (Kozlov and Jalava 1994; Kozlov and Kullberg 2008), the Karelia Republic (Gorbach 2014), the Komi Republic, and the Nenets Autonomous Okrug (Bolotov 2011; Vlasova et al. 2014; Tatarinov 2016; Kozlov et al. 2019). Only two records of *B. frigga* are known on the Arctic islands of Northern European Russia, i.e. the Novaya Zemlya Archipelago and Dolgiy Island (review: Kullberg et al. 2019) (Table 1, Fig. 1).

Kolguev Island is one of the poorly studied territories of the European Arctic. This remote island has been little visited by entomologists. Only a few published information concerning the insect fauna, are known regarding this island. Six species of Nymphalidae have been recorded here previously, i.e. *Boloria chariclea* (Schneider, 1794), *B. polaris* (Boisduval, 1828), *Vanessa cardui* (Linnaeus, 1758), *Erebia disa* (Thunberg, 1791), *E. pandrose* (Borkhausen, 1788), *E. rossii* (Curtis, 1835) (Bolotov 2011; Kullberg et al. 2019). In all, no more than 21 species of Lepidoptera have been

Table 1. List of records of *Boloria frigga* in the north-eastern part of European Russia.

Nº	Locality (type)	N	E	References
1	Kolguev Island, 2 km N from Bugrino (settlement)	68°48'	49°17'	this study
2	Mesna (river)	–	–	Tatarinov 2016
3	Shoyna (settlement)	67°52'	44°09'	Tatarinov 2016
4	Shchuchye (lake)	67°26'	44°32'	Tatarinov 2016
5	Golodnaya Guba (lake)	67°56'	52°46'	Tatarinov 2016; Kozlov et al. 2019
6	Naryan-Mar (town)	67°38'	53°00'	Tatarinov 2016; Kozlov et al. 2019
7	Korovinskaya (bay)	68°11'	53°58'	Tatarinov 2016
8	Shapkina (river)	–	–	Tatarinov 2016
9	Dolgiy Island	69°16'	59°06'	Kullberg et al. 2019
10	Paiyakha (river)	69°20'	62°03'	Tatarinov 2016
11	Amderma (settlement)	69°45'	61°40'	Kozlov et al. 2019; Vlasova et al. 2014
12	Novaya Zemlya Archipelago	–	–	Kullberg et al. 2019

Notes: № corresponds to a number of the locality on the map (Fig. 1). With regards to several localities, it is impossible to determine the coordinates in a sufficiently accurate manner. These records are included without coordinates.

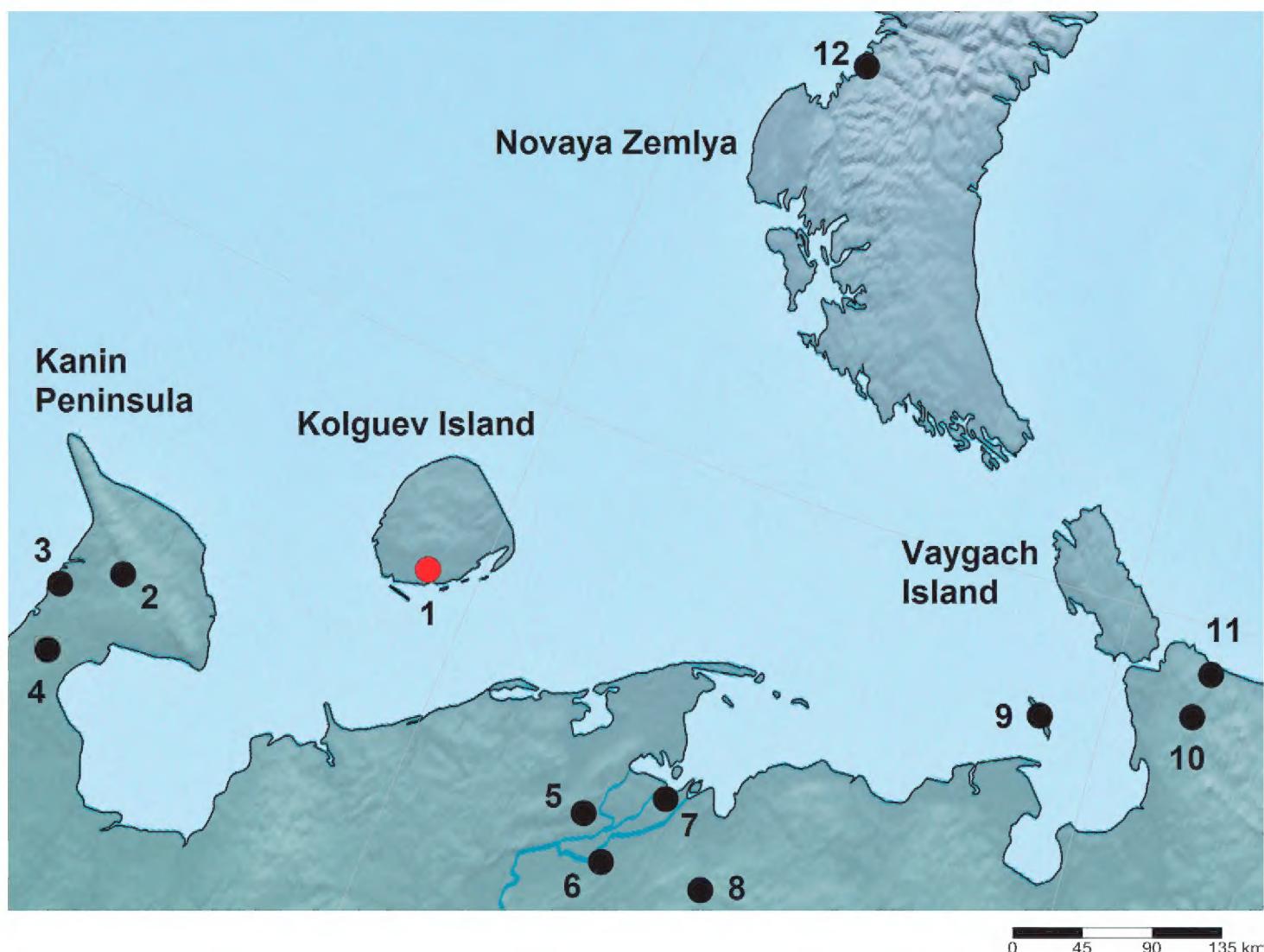


Figure 1. Map of the north-eastern part of European Russia. Records of *Boloria frigga* are shown as black dots, according to the published data. The first record on Kolguev Island is presented as a red dot. Numbers for the localities are given in Table 1.

recorded so far from the Kolguev Island, making it one of the least studied islands from within Arctic islands of Russia (Kullberg et al. 2019; Spitsyn and Bolotov 2020). New records may allow us to create in the future a complete species list of Lepidoptera for this remote Arctic island. These data, regarding Lepidoptera in Arctic islands, are important in connection with the forecasts of changes in the ranges of species of insects under conditions of global warming.

A specimen of *B. frigga* was collected with an entomological net. It was prepared using the standard methods (Schauff 2001). The butterfly is deposited in the Russian Museum of Biodiversity Hotspots [RMBH], N. Laverov Federal Center for Integrated Arctic Research of the Ural Branch of the Russian Academy of Sciences (Arkhangelsk, Russia). The images of the specimen were taken with a Canon EOS 7D camera (Canon Inc., Tokyo, Japan). The source of the map is the online software SimpleMappr (Shorthouse 2010).

The first record: Russia, Kolguev Island (southern part), 2 km N from Bugrino near the Bugryanka River, moss-herb tundra, 68°48'04.1"N; 49°17'40.0"E, 16.vii.2020, Grigory Potapov leg. – 1♂ (Fig. 2).

B. frigga might be confused with *B. chariclea* (Schneider, 1794), *B. freija* (Thunberg, 1791), *B. polaris* (Boisduval, 1828). Upperside of wings of *B. frigga* with black heavy marking; upper hindwing with wide basal and discal black suffusion; under hindwing with a white basal spot at wing costa, white marginal spots absent (Tuzov and Bozano 2006).

B. frigga is widespread, but generally local in Northern European Russia. On the mainland, the number of records is quite a lot (Table 1, Fig. 1). Our record is located ca. 170 km northwards of the previous known locality of *B. frigga*. Before our study, we can indicate only two localities for the Arctic islands, where *B. frigga* was known.

Obviously, that further research in these remote tundra areas will increase the number of records of *B. frigga*. On Kolguev Island, the central and northern parts of this island with hills and river valleys are more prospective for the study. It seems that here, the Lepidoptera fauna is richer (Bolotov 2011).

The status of the population of *B. frigga* needs to be monitored in the European part of Russia. The disappearance of raised bogs, as a result of their economic use, has a negative impact on this species. The populations of *B. frigga* in the tundra zone appear more sustainable at the present time.

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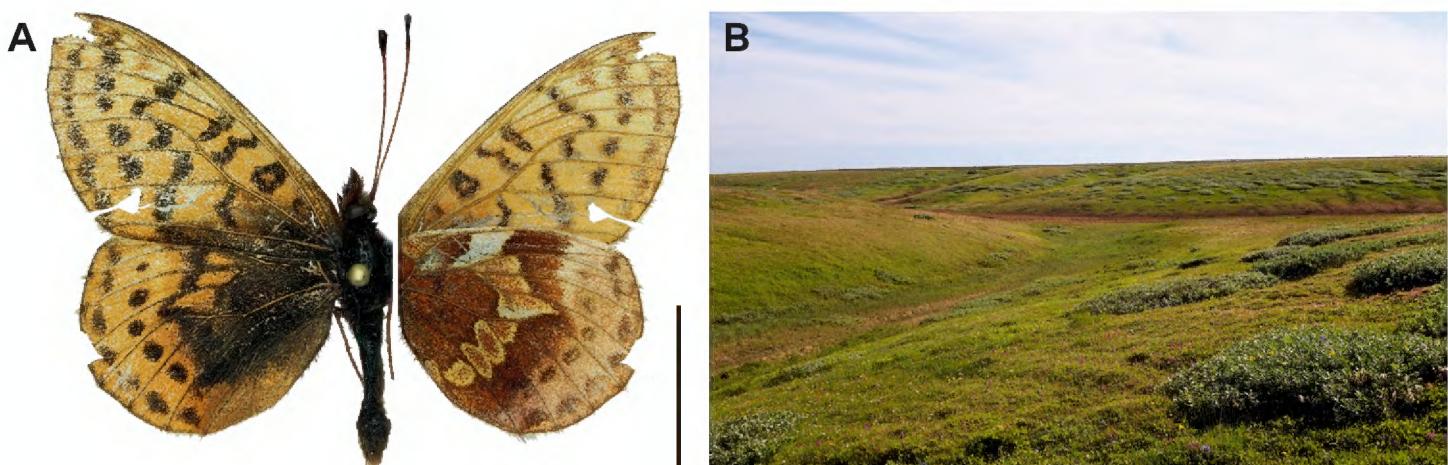


Figure 2. *Boloria frigga* on Kolguev Island: **A** General view of the specimen. Scale bar = 10 mm. (Photo: Elizaveta A. Spitsyna); **B** Habitat (moss-herb tundra) of this species on Kolguev Island (Photo: Grigory S. Potapov).

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